Limited Visual Dam Safety Inspection Summary Report

HI - 00122

Waikoloa 50 MG Reservoir 2

Hawaii, Hawaii

Prepared by:

U.S. ARMY CORPS OF ENGINEERS
HONOLULU ENGINEER DISTRICT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

May 2006

Dam ID: HI00122
Name: Waikoloa 50 MG Reservoir 2

Limited Visual Dam Safety Inspection Conducted on: 7 April 2006

I. Purpose:

Due to disaster occurrences of periodic heavy rains and flooding, which has caused extensive damage to property and loss of lives, the Governor has issued a State of Emergency Proclamation extending from February 20, 2006 to April 9, 2006. In light of the tragic failure of the Kaloko dam on Kauai and the continued forecast of heavy rains, emergency inspections of all regulated dams in all counties are being undertaken.

These inspections are for the purpose of determining if any of the regulated dams and reservoirs in the City and County of Honolulu, Maui County or Hawaii County, are suspect for immediate concern to the downstream area under the prolonged conditions of heavy rain showers.

II. Authority

Inspections were authorized under the Hawaii Dam Safety Act of 1987, Chapter 179D "Dams and Reservoirs" of Hawaii Revised Statues, and Title 13, Subtitle 7, Chapter 190, "Dams and Reservoirs" of the Hawaii Administrative Rules.

These inspections were conducted under joint agreements of the U.S. Army Corps of Engineers (ACE), the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), and the State of Hawaii. The Memorandum of Agreement with the U.S. Army Corps of Engineers is entered into pursuant to 10 U.S.C. § 3036(d)(2), and the Intergovernmental Cooperation Act (31 U.S.C. §6505), and established via support agreement number DL-06-01.

III. Scope

Visual inspection was performed on parts of the embankment and appurtenant works readily available and visible for inspection by the inspection team at the time of the inspection. Such parts and appurtenant works included the upstream slope, crest, downstream slope, abutments and toes, outlet works, and spillway.

On the date of this limited visual inspection, there may or may not have appeared to be any immediate threat to the safety of the dam, however no assurance can be made regarding the dam's condition after this date. Subsequent adverse weather and other factors may affect the dam's condition.

IV. Limitations of Findings and Recommendations

The inspection is based only on visible features/areas of the dam on the day of inspection. The inspection does not entail detailed stability, hydrologic, hydraulic, or seismic investigations. This inspection is not a formal phase I or phase II dam safety inspection and does not include a review or evaluation from each specialist of an inspection team, such as a geologists, civil, geotechnical, structural, or hydraulics engineer. The owner should verify the findings of this report and take corrective actions. The owner may submit to the State alternative corrective actions that are certified by a licensed professional engineer in the State of Hawaii experienced in the design and construction of dams. This inspection does not relieve the owner/operator from their responsibility to conduct routine inspections, maintenance, repairs, modifications, monitoring, documentation, and/or investigative studies.

V. Inspection Team

Organization	Name
U.S. Army Corps of Engineers	Ray Kong
State of Hawaii, Dept. of Land and Natural Resources	Morris Ota
State of Hawaii, Dept. of Land and Natural Resources	Kevin Ho
National Resource Conservation Service	April Harden

VI. Owner's Representatives Present

Mr. Gerald Yorita and Mr. William Yamamoto, representing Hawaii County, Dept. of Water Supply

VII. Summary Report Team

Organization	Name
U.S. Army Corps of Engineers	Derek Chow
	Joseph Koester
State of Hawaii, Dept. of Land and Natural Resources	Denise Manuel
	Edwin Matsuda

VIII. Dam Type

The dam is an earthen embankment.

IX. Dam Classification

The current hazard classification of this dam is: High
Based on available data, this classification is believed to still be applicable.

Hazard Potential Classification based on the following:

Category	Loss of Life	Economic Loss
Low	None Expected	Minimal (undeveloped to occasional structures or agriculture)
Significant	Few (No Urban development and no more than a small number of inhabitable structures)	Appreciable (Notable agriculture, industry or structures)
High	More than a few	Extensive community, industry or agriculture.

Based on inventoried storage and height data, the size classification of the dam is: Small

Size Classification based on the following:

Category	Storage (Acre-Feet)	Height (feet)
Small	< 1000	< 40
Intermediate	> 1000 and < 50,000	> 40 and < 100
Large	> 50,000	> 100

Dam ID: HI00122
Name: Waikoloa 50 MG Reservoir 2

X. Summary of Inspection:

Condition Rating Criteria: The conditional terms in this report are used to generally describe the conditions below. Inspections, monitoring, and additional investigations are considered to be incidental to all condition ratings.

Satisfactory	Expected to fulfill intended function.
Fair	Expected to fulfill intended function, but maintenance is recommended.
Poor	May not fulfill intended function; maintenance or repairs are necessary.
Unsatisfactory	Is not expected to fulfill intended function; repair, replacement, or modification is necessary.
Unknown	Not visible, not accessible, not inspected, or unable to determine the condition rating based on the observation taken.

A. General appearance:

All features of the reservoir and dam features were not easily recognizable due to heavy vegetation on the downstream slopes and the reservoir being partially filled with water.
Modifications / Improvements: There were no signs of any recent modifications. Based on topography, no offsite drainage expected.

Findings and Corrective Actions:

a. The Owner shall maintain documentations including Construction plans, specifications, improvements, modifications, Operations and Maintenance Manuals and routine inspection logs for this dam facility.
b. An EAP is recommended for all dams regardless of hazard class. Submit EAP if developed for the facility.
c. Submit narrative and additional information detailing any improvements, modifications, and/or alterations at the dam site, unless covered by approved dam permit.
d. Routine inspection logs were not inspected.
e. Dam owners shall provide for routine inspection of the dam.
f. Access to site appears to be satisfactory.
g. Dam owners are required to promptly advise the department of any sudden or unprecedented flood or unusual or alarming circumstance or occurrences, which may adversely affect the dam or reservoir.
h. Submit current Operations and Maintenance Manual or Procedures for this dam / reservoir facility.
i. Submit Site or Facility Map of this Dam which identifies the location of major features including outlet works controls and conduits.
j. Emergency Alarms / Monitors. There were no alarms or monitors observed on this reservoir.
k. Power / Communication. There were no communication systems observed on this reservoir. There were no utility or power poles visible nearby.

B. Access / Security:

Access to the dam was accomplished via a County roadway.
A four wheel drive vehicle is not required.

C. Inflow Works:

According to staff personnel, there is one inlet feeding the reservoir.
The inlets have the ability to be shut off or diverted away from the reservoir during periods of heavy rains. This is done manually.

Findings and Corrective Actions:

a. The intake works were inspected only at the inlet to the reservoir.
b. The intake works were not tested.
c. The intake works appeared to be in satisfactory condition, no corrective actions are required at this time.

D. Reservoir

The reservoir level during the inspection was 23 feet per staff gage.

Findings and Corrective Actions:

a. The reservoir was not fully inspected due to water in the reservoir.
b. The reservoir appeared to be in satisfactory condition, no corrective actions are required at this time.

E. Upstream Slope (Satisfactory)

The upstream slope stands at a 1V: 1H (Vertical / Horizontal) slope.
The slope is concrete lined. Erosions were not observed, the slope was not entirely visible. Cracks were not observed; the slope was not entirely visible.
Sinkholes were not observed, the slope was not entirely visible.
The upstream slope was not entirely visible due water in the reservoir.

Findings and Corrective Actions:

a. The upstream slope was not fully inspected, underwater.
b. The upstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.

F. Crest: (Satisfactory)

The dam crest was approximately 15 feet wide. There was an AC surfaced access road on top of the crest, which has grass growing through it. Minor erosion was observed, limited primarily to tire ruts. Vegetation was observed on the downstream shoulder of the crest. These were primarily high grass.

Findings and Corrective Actions:

a. The dam crest appeared to be in satisfactory condition, no corrective actions are required at this time.

G. Downstream Slope: (Fair)

The downstream slope was in fair condition and not visible due to heavy vegetation. The slope was around a 1V to 2H slope. There was partial access to the downstream. There was no slope protection observed on the downstream slope. Erosion was not observed on the downstream slope, however the slope was not entirely visible. Sinkholes were not observed on the downstream slope, however the slope was not entirely visible. Vegetation was observed on the downstream slope. The majority of the vegetation was woody trees ranging from 8" to 2 feet in diameter. Seepage was not observed on the downstream toe, however the slope was not entirely visible.

Findings and Corrective Actions:

a. The downstream slope was not inspected.
b. The downstream slope appeared to be in fair to poor condition and requires corrective action.
c. The down stream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
d. Seepage/Ponding water was observed. Monitor and conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.

H. Abutments / Toe: (Fair)

The abutments and toe were not entirely visible or identifiable due to heavy vegetative growth. Erosion along the abutment or toe was not observed. Cracks in either direction were not observed, however the crest was not entirely visible. There was heavy vegetation along the abutments and toe locations.

Findings and Corrective Actions:

a. The abutments/toe were not inspected.
b. The abutments/toe appeared to be in fair to poor condition and requires corrective action.
c. The abutment/toe area was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
d. Seepage/Ponding water was observed. Monitor and conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.
e. Consider constructing a toe drain in order to collect and measure seepage.

I. Outlet Works: (Unknown)

Not inspected in detail, not tested. The outlet works was controlled via a gate valve on the downstream side of the dam. Seepage was not observed flowing near the exit of the outlet works from the dam.

Findings and Corrective Actions:

a. The outlet works were not inspected / not tested.
b. The outlet works appeared to be in satisfactory condition, no corrective actions are required at this time.

J. Spillway: (Satisfactory)
This spillway consisted of a concrete channel. The rough dimensions were 4 feet by 6 feet. The spillway channel then feeds a drainage swale that heads downstream. The spillway approach was clear. There was no erosion observed near the spillway. The downstream vegetation appears to be primarily tall grass vegetation. Further investigations should be conducted to conclude the capacity of the spillway.

Findings and Corrective Actions:
a. The Spillway appeared to be in satisfactory condition, no corrective actions are required at this time.

K. Down Stream Channel: (Unknown)
The down stream channel was not investigated.

XI. Additional Comments:

Original field inspection notes were scanned and are attached to this summary report. Included are several photos from the site visit to detail important features of the project, captioned to be self-explanatory.

Per e-mail dated 5/1/2006 4:17 pm from Ray Kong, USACE.

Vehicle access to the site: Standard car is okay
Other studies conducted: Unknown.
Rating of access to the site: Satisfactory

Reservoir:
Normal Operating Level/Range: About 21 feet. Staff gage observed in the reservoir.

For Reservoir 2, located across from the spillway. (per e-mail dated 2 May 06 10:43 am)

Upstream slope:
Sinkholes: None observed.

Abutment/Toe:
Please provide information on seep. No corrective action taken since last inspection. Recommend regular monitoring.

Downstream channel:
Please provide information on downstream channel. Not observed.

Comments:
No immediate threat observed for the dam or reservoir at the time of inspection. Recommend regular monitoring even installing devices to monitor quantity and clarity of seepage water.

PHOTOGRAPHS

Dam ID: HA-122
Name: Waikoloa 50 MG Reservoir 2

View of reservoir with lined upstream slope

View of reservoir

Dam ID: HA-122
Name: Waikoloa 50 MG Reservoir 2

Another view of the reservoir

View of the crest

Dam ID: HA-122
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View of the downstream slope

View of the inflow works

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Emergency inflow pipe, used to bring in more water

View of the inflow works

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View of spillway and downstream channel

View of spillway upstream, inches of water flowing

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View of spillway and downstream channel

View of downstream slope with seepage observed

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View of downstream slope

View of downstream slope with seepage observed

FIELD INSPECTION SHEETS

Dam ID: HA-0122
WAIKOLOA 50 MG RESERVOIR 2

Vulnerability Index:
Extreme High Moderate Low
1 2 3 4

Inspection No: _____
Date: 7 APRIL 2006

STATE OF HAWAII - DLNR
DAM SAFETY INSPECTION SHEET

Inspection Type: Visual Dam Safety Inspection

Persons Present	Affiliation	Phone Number
RAY KONG	US Army Corps of Engineers	
MORRIS UTA	DLNR	
APRIL HARDEN	NRCS	
KEVIN HO	DLNR	
GERALD YOKOTA	DWS	
WILLIAM YAMAMOTO	DWS	

Weather Condition: ☐ Rain previous day ☑ Rainy ☐ Drizzle / Mist ☐ Cloudy/Overcast ☐ Partly Cloudy ☐ Sunny ☐ Dry
Comments: _____

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1. General: *(Information currently on file, update as required)*

Dam/Res. Name: WAIKOLOA 50 MG RESERVOIR 2
Owner: Hawaii County, Department of Water Supply *(C011)*
Owner Contact: Mr. Kurt Inaba — Owner Ph. _____
Lessee: N/A — Lessee Ph. _____
O & M Contractor: Hawaii County — O & M Ph. _____
Nearest Town: WAIMEA — Latitude: 20.0433 ° (decimal)
County: HAWAII — Longitude: 155.68 ° (decimal)
Tax Map Key(s): (3)6-5-001:011

Dam Status	A:	Hazard Potential	H:	Dam Size	
Year Completed	1975	Dam Length	2000 ft.	Dam Height	35 ft.
Normal Storage	157 ac.ft.	Max. Storage	190 ac.ft.	Max. Surface Area	7 ac.
Drainage Area	mi.	Spillway Type		Max. Spillway Q	250 cfs

Owner owns land under dam facility: _____
Emergency Action Plan on file with the Department: YES
Reports on file with the Department: July 1996 = Dam Safety Inspection, Woodward Clyde & Assoc. (8)
Sept. 1978 = Army Corps of Engineers, Initial Dam Safety Inspection / Survey (2)

Dam ID: HA-0122
WAIKOLOA 50 MG RESERVOIR 2

Inspection No: _____
Date: 4/7/06

2. Questions for Owner's Rep.:

	Yes	No	Unknown	Comments
Construction Plans Available	☐	☐	☑	
Site / Facility Map	☐	☐	☑	
Operation & Maintenance Manual	☐	☐	☑	
Emergency Action Plan	☐	☐	☑	
Modifications / Improvements	☐	☐	☑	
Conduct Routine Inspections	☐	☐	☑	
Conduct Routine Maintenance	☑	☐	☐	
Vehicle access to site	☐	☐	☐	☐ Not accessible ☐ With Standard car ☐ Requires 4-Wheel Drive
Access during heavy rains	☑	☐	☐	☐ Not accessible ☑ With Standard car ☐ Requires 4-Wheel Drive
Access when spillway is flowing	☑	☐	☐	☐ Not accessible ☑ With Standard car ☐ Requires 4-Wheel Drive
Other Studies Conducted	☐	☐	☐	☐ Phase I ☐ Phase II ☐ Hydraulics ☐ Stability ☐ Hazard ☐ Seismic ☐ Other: _____
Incident History	☐	☑	☐	☐ Breached ☐ Overtop ☐ Slide ☐ Down stream Flooding ☐ Other: _____
Reservoir's Current Use	☑	☐	☐	☐ Sediment ☑ Irrigation ☐ Recreation ☐ Flood Control ☑ Drinking Water ☐ Power Generation ☐ Other: _____

Findings and Corrective Actions:

- ☑ a. The Owner shall maintain documentations including Construction plans, specifications, improvements, modifications, Operations and Maintenance Manuals and routine inspection logs for this dam facility.
- ☐ b. An Emergency Action Plan (EAP) is on file with the department, submit any updates as applicable.
- ☑ c. An EAP is required for High Hazard Dams. Submit an updated EAP for this facility.
- ☐ d. An EAP is recommended for all dams regardless of hazard class. Submit EAP if developed for the facility.
- ☐ e. Submit narrative and additional information detailing the improvements, modifications, and/or alterations at the dam site, unless covered by approved dam permit.
- ☑ f. Routine inspection logs were not inspected.
- ☑ g. Dam owners shall provide for routine inspection of the dam.
- ☐ h. The dam did not appear to be maintained on a regular basis.
- ☐ i. Access to site appears to be satisfactory.
- ☐ j. There is no vehicular access to the dam site. Operational and emergency plans need to reflect this deficiency or access provided.
- ☐ k. Access to dam is questionable during severe weather conditions and/or spillway overflows. Operational plans and emergency plans need to reflect this deficiency or access provided.
- ☐ l. Provide a detailed narrative of the incident, responses taken, and any damages incurred. Dam owners are required to promptly advise the department of any sudden or unprecedented flood or unusual or alarming circumstance or occurrences which may adversely affect the dam or reservoir.
- ☐ m. Submit current Operations and Maintenance Manual or Procedures for this dam / reservoir facility.
- ☐ n. Submit Site or Facility Map of this Dam which identifies the location of major features including outlet works controls and conduits.
- ☐ o. _____

Additional Requirements:

The following investigative study(s) are:

Required	Recommended	
☐	☐	Phase I Study
☐	☐	Phase II Study (Including ☐ Seepage ☐ Hydrology/Hydraulics ☐ EAP)
☐	☐	Hydrology and Hydraulics (including Probable Maximum Flood and spillway capacity)
☐	☐	Stability Analysis
☐	☐	Seismic Analysis
☐	☐	Hazard Classification
☐	☐	Other: _____

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WAIKOLOA 50 MG RESERVOIR 2

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Physical Dam Features: (Check All Applicable. Provide description of Items Observed and/or Take Photos. Indicate photo # in description.)

3. Reservoir:

Level during inspection 23 ft per STAFF (gage / other)

Normal Operating Level/Range _____ ft per _____ (gage / other)

Description: _____

Typical Operation ☐ Spillway always flowing ☑ Kept within normal range ☐ Kept Empty ☐ Drained Daily ☐ Only filled by Storms

☐ Other: _____

Sinkhole in Res.: ☐ # Observed: _____ Size: _____ by _____ in. Deep ☑ Not Visible ☑ None Observed

Description: UNDERWATER

Staff Gage: Description: _____

Findings:

- ☐ a. The reservoir was not inspected.
- ☑ b. The reservoir appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ c. The reservoir appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The reservoir appeared to be in unsatisfactory condition, urgent corrective action is required.

Corrective Actions:

- ☐ e. The staff gage needs maintenance and/or repair. Description: _____
- ☐ f. A staff gage was not observed at the reservoir. Provide some method of quantifying the water level within the reservoir.
- ☐ g. A sinkhole was observed in the upstream reservoir. Conduct additional investigations and monitoring to identify the cause, risk and appropriate action.
- ☐ h. _____

4. ~~Intake~~ INFLOW Works Description:

☑ Number of Intakes 1

☑ Intake Culvert / Pipe

Size: 16 in. ☑ DIP ☐ Corrugated Metal ☐ PVC ☐ HDPE ☐ Concrete ☐ Other _____

Control: ☐ Gate ☑ Valve ☐ Flow can either be Shut off or Bypassed

From: ☑ Stream Diversion ☐ Pump ☐ Reservoir ☐ Other _____

☐ Ditch / Flume

Dimension: _____ (Size x Depth) Shape _____

Surface: ☐ Dirt ☐ Wood ☐ Concrete ☐ Lined w/ _____

Control: ☐ Gate ☐ Valve ☐ Flow can either be Shut off or Bypassed

From: ☐ Stream Diversion ☐ Pump ☐ Reservoir ☐ Other _____

Findings:

- ☑ a. The intake works were not inspected.
- ☑ b. The intake works were not tested.
- ☑ c. The intake works appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ d. The intake works appeared to be in fair to poor condition and requires corrective action.
- ☐ e. The intake works appeared to be in unsatisfactory condition, urgent corrective action is required.

Corrective Actions:

- ☐ f. The intake works needs maintenance and/or repair. Description: _____
- ☐ g. _____

Dam ID: HA-0122 WAIKOLOA 50 MG RESERVOIR 2	Inspection No: _____ Date: 4/7/06

5. Upstream Slope: **(Typical Slope ± 1V : 1H)**

Slope Protection: ☐ None ☐ Dumped Rock ☐ Fitted Rip Rap ☐ Grouted Rip Rap ☑ Liner CONC. ☐ Other: _____

☑ Defect in Protection: Description: REPAIRED

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☑ None Observed

Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☑ None Observed

Description: REPAIRS SEEN IN JOINTS (EPOXY)

Sinkholes: ☐ # Observed: _____ Size: _____ and _____ Depth ☑ Not Visible ☑ None Observed UNDERWATER

Description: _____

Vegetation: ☑ None ☐ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"

Description: _____

Findings:

☑ a. The upstream slope was not inspected. UNDERWATER

☐ b. The upstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.

☐ c. The upstream slope appeared to be in fair to poor condition and requires corrective action.

☐ d. The upstream slope appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ e. Slope protection needs maintenance or repair. Description: _____

☐ f. Rut and/or Gully erosion was observed on the slope, which requires maintenance and/or repair. Description: _____

☐ g. A crack was observed on the slope, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.

☐ h. A sinkhole was observed on the slope, which requires further investigation to determine the underlining cause. Repair and monitor the area.

☐ i. The upstream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.

☐ j. Tree(s) were observed on the dam embankment. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.

☐ k. _____

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6. Crest: Approximate Crest Width: 15'

Access: ☐ None ☐ Walking Path ☑ Roadway, Surface / Width / Usage: AC/ GRASSED

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☑ None Observed
Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☑ None Observed
Description: _____

Sinkholes: ☐ _____ in. Wide x _____ in. Long x _____ in. Deep ☐ Not Visible ☑ None Observed
Description: _____

Vegetation: ☐ None ☑ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"
Description: _____

Findings:

- ☐ a. The dam crest was not inspected.
- ☑ b. The dam crest appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ c. The dam crest appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The dam crest appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ e. Access along the crest was satisfactory.
- ☐ f. Access along the crest was not possible. Description: _____
- ☐ g. Rut and/or Gully erosion was observed on the crest, which requires maintenance and/or repair. Description: _____
- ☐ h. A crack was observed on the crest, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ i. A sinkhole was observed on the crest, which requires further investigation to determine the underlining cause. Repair and monitor the area.
- ☐ j. Portions of the crest were not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☐ k. Tree(s) were observed along the dam crest. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☐ l. _____

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7. Downstream Slope:

(Typical Slope ± 1V : 2H)

Access: ☑ lower roadway along toe (PARTIAL) ☐ roadway to outlet works ☐ walkway to outlet works ☐ None Observed

Slope Protection: ☑ None ☐ Dumped Rock ☐ Rip Rap ☐ Grouted Rip Rap ☐ Concrete

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☑ None Observed

Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☑ None Observed

Description: _____

Sinkholes: ☐ _____ in. Wide x _____ in. Long x _____ in. Deep ☐ Not Visible ☑ None Observed

Description: _____

Vegetation: ☐ None ☑ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"

Description: _____

Seepage:

Seep Spot Number 1

☑ Green Vegetation ☑ Wet or Muddy Ground ☑ Ponding Water ☐ Not Visible ☐ None Observed

☑ Flowing, Description: Due to wet condition flow was difficult to determine

Water Clarity: ☑ Clear ☐ Some particles ☐ Muddy ☐ Other: Iron Stained

Description: Seep begin on east portion of reservior and flower is wet to the south east portion.

TTC

Seep Spot Number 2

☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☐ None Observed

☐ Flowing, Description: _____

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Findings:

- ☐ a. The downstream slope was not inspected.
- ☑ b. The downstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☑ c. The downstream slope appeared to be in fair to poor condition and requires corrective action. TTC
- ☐ d. The downstream slope appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ e. Slope protection needs maintenance or repair. Description: _____
- ☐ f. Rut and/or Gully erosion was observed on the slope, which requires maintenance and/or repair. Description: _____
- ☐ g. A crack was observed on the slope, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ h. A sinkhole was observed on the slope, which requires further investigation to determine the underlining cause. Repair and monitor the area.
- ☐ i. The down stream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☐ g. Tree(s) were observed on the downstream slope. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☑ h. Seepage/Ponding water was observed. Monitor and conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition. TTC
- ☐ i. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil from the embankment. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area.
- ☐ j. The slope was very steep, around a 1 to 1 slope, further study is required to verify slope stability.
- ☐ k. Consider constructing a toe d TTC

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8. Abutments/Toe:

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☑ None Observed
Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☑ None Observed
Description: _____

Vegetation: ☐ None ☑ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"
Description: _____

Seepage:
Seep Spot Number 1
☑ Green Vegetation ☑ Wet or Muddy Ground ☑ Ponding Water ☐ Not Visible ☐ None Observed
☑ Flowing, Description: Due to wet conditions flow was difficult to detect.
Water Clarity: ☑ Clear ☐ Some particles ☐ Muddy ☑ Other: Iron stained
Description: Seep begins on east side of reservior and flows or is wet to the south portion

Seep Spot Number 2
☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☐ None Observed
☐ Flowing, Description: _____
Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____
Description: _____

Findings:

☐ a. The abutments/toe were not inspected.
☐ b. The abutments/toe appeared to be in satisfactory condition, no corrective actions are required at this time.
☑ c. The abutments/toe appeared to be in fair to poor condition and requires corrective action.
☐ d. The abutments/toe appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ e. Slope protection needs maintenance or repair. Description: _____
☐ f. Rut and/or Gully erosion was observed, which requires maintenance and/or repair. Description: _____
☐ g. A crack was observed along the abutments/near the toe, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
☐ h. The abutment/toe area was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
☐ i. Tree(s) were observed along the abutment/toe. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
☑ j. Seepage/Ponding water was observed. Monitor and conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.
☐ k. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil from the embankment. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area.
☑ l. Consider constructing a toe drain in order to collect and measure seepage

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9. Outlet Works:

Culvert / Pipe

Type / Size: 16" DIP underground and connected to Reservior 1

Culvert: ☐ Concrete ☐ Masonry ☐ unlined earth ☐ Other

Pipe: ☑ DIP ☐ Corrugated Metal ☐ PVC ☐ HDPE ☐ Concrete ☐ Other

Control Type: ☐ Gate ☐ Valve ☐ Other

Location: ☐ Control on Upstream side ☑ Control on Downstream side

Seepage: ☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☐ None Observed

☐ Flowing, Description:

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other:

Description:

Findings:

☑ a. The outlet works were not inspected.

☑ b. The outlet works were not tested.

☐ c. The outlet works appeared to be in satisfactory condition, no corrective actions are required at this time.

☐ d. The outlet works appeared to be in fair to poor condition and requires corrective action.

☐ e. The outlet works appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ f. Seepage/Ponding water was observed. Conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.

☐ g. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area. Failures caused by seepage/piping along the outlet conduit are very common and are considered to be a dangerous situation.

☐ h. Were not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.

☐ i.

☐ j.

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10. Spillway:

Type: ☐ None ☐ Culvert/Pipe ☑ Channel CONC.
Description: BOX, 4'x6'

Dimension: _____ ft. Invert elevation: _____ ft. per staff gage

Slope Protection: ☐ None ☑ Grass ☐ Dumped Rock ☐ Fitted Rip Rap ☐ Grouted Rip Rap ☑ Concrete
☐ Defect in Protection: Description: _____

Approach: ☑ Clear ☐ High Veg. ☐ Trees ☐ Other: _____

Erosion: ☐ Scour ☐ Gully ☐ Headcut ☑ Not Observed ☐ Other: _____
Description: _____

Vegetation: ☑ None ☐ Low Ground Cover ☑ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"
Description: DOWNSTREAM, BEYOND LINER

Findings:

☑ a. The Spillway appeared to be in satisfactory condition, no corrective actions are required at this time.
☐ b. The Spillway appeared to be in fair to poor condition and requires corrective action.
☐ c. The Spillway appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ d. Slope protection needs maintenance or repair. Description: _____
☐ e. The spillway approach was blocked. Clear approach.
☐ f. Severe scour erosion was observed which requires maintenance and/or repair.
Description: _____
☐ g. A headcut (vertical drop in channel due to erosion) was observed downstream of the spillway. Corrective action is required to prevent this problem from moving upstream.
☐ h. Trees are unacceptable in the spillway channel and approach. Take corrective action to address the woody vegetation problem and repair the damaged area.
☐ i. Unclear if spillway is adequately sized. Spillway should pass the probable maximum flood. Verify spillway capacity and take corrective action as required.
☐ j. _____

11. Down Stream Channel:

Name: _____
Downstream: ☐ Sump ☐ Open Area ☐ Un-Defined Drainage-way ☐ Defined Drainage-way ☐ Other _____
Items along Stream Bank: ☐ None ☐ Road ☐ Houses ☐ Town ☐ Not Inspected
Description: _____

Findings:

☐ a. The downstream channel was not inspected.
☐ b. The downstream channel appeared to be in satisfactory condition, no corrective actions are required at this time.
☐ c. The downstream channel appeared to be in fair to poor condition and requires corrective action.
☐ d. The downstream channel appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ e. _____

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Additional Comments:

On the date of this limited visual inspection, there appeared to be no immediate threat to the safety of the dam. No assurance can be made regarding the dam's condition after this date. Subsequent adverse weather and other factors may affect the dam's condition.

Limitations and Intent of this Dam Safety Inspection:

This Dam Safety Inspection was conducted to assess the general overall condition of the reservoir/dam, identify visible deficiencies, and recommend areas of for monitoring, additional investigative studies and corrective actions. The inspection is based only on visible features/areas of the dam on the day of inspection. This inspection is not a formal phase I or phase II dam safety inspection and does not include a review or evaluation from each specialist of an inspection team, such as a geologists, civil, geotechnical, structural, or hydraulics engineer. The owner should verify the findings of this report and take corrective actions. The owner may submit to the State alternative corrective actions that are certified by a licensed professional engineer in the State of Hawaii experienced in the design and construction of dams. This inspection does not relieve the owner/operator from their responsibility to conduct routine inspections, maintenance, repairs, modifications, monitoring, documentation, and/or investigative studies. The inspection was conducted under the authority of the Hawaii Revised Statures Chapter 179D, and Hawaii Administrative Rules, Title 13, Chapter 190, titled "Dams and Reservoirs". Questions regarding this inspection should be forwarded to the Hawaii State Dam Safety Program; PO Box 373; Honolulu, Hawaii 96809; Ph. (808) 587-0236.

Revised: Dec. 1, 2003